Nonlinear optics with 2D materials for frequency conversion and gas sensing

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Abstract

Two-dimensional (2D) materials are ideal candidates for nanoscale nonlinear optical devices such as frequency converters and gas sensors thanks to their ease of integration on photonic platforms (fibers, waveguides and microrings) and their strong nonlinear optical response. In this seminar I will show few examples that highlight the impact of 2D materials in the aforementioned applications. First, I will discuss high-speed and ultra-broadband electrical and all-optical frequency converters based on third harmonic generation in graphene [1] and second harmonic generation in transition metal dichalcogenides [2]. Finally, I will present the performances of a hybrid graphene/D-shaped fiber where the strong doping dependence of the four-wave mixing process is used to achieve single molecule detection sensitivity [3].

References

[1] G. Soavi et al., Nature Nanotechnology 13, 583 (2018)

[2] S. Klimmer et al., submitted

[3] N. An et al., Nano Letters 20, 6473 (2020)